

IN THE CLAIMS

This listing of claims replaces all prior versions and listings of the claims in the above-referenced application.

1. (Currently Amended) A light emitting device having a stack of layers including semiconductor layers comprising an active region, said device comprising:

a transparent lens attached to said stack by a bond effected at an interface disposed between said lens and said stack, ~~wherein said bond does not include epoxy;~~

wherein said lens is bonded to a surface of said stack, and wherein a smallest ratio of a length of a base of said lens to a length of said surface is greater than about one.
2. (Original) The light emitting device of Claim 1, wherein a shape of said lens is selected from the group of Weierstrass sphere, hemisphere, portions of a sphere less than a hemisphere, ellipsoid, and portions of an ellipsoid.
3. (Original) The light emitting device of Claim 1, wherein said lens is a Fresnel lens.
4. (Original) The light emitting device of Claim 1, wherein said lens is a graded index lens.
5. (Original) The light emitting device of Claim 1, wherein said lens is formed from a material selected from the group of optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors and compounds, metal oxides, metal fluorides, diamond, yttrium aluminum garnet, and combinations thereof.
6. (Previously Amended) The light emitting device of Claim 1, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, GaP, ZnS, materials containing lead oxide, materials containing tungsten oxide, and SiC.

7. (Original) The light emitting device of Claim 1, wherein said lens includes one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

8. (Original) The light emitting device of Claim 1, wherein said lens is coated with one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

9. (Canceled).

10. (Currently Amended) The light emitting device of Claim 9 1, wherein said ratio is greater than about two.

11. (Original) The light emitting device of Claim 1, wherein said stack is located in a recess of a surface of said lens.

12. (Original) The light emitting device of Claim 1, wherein a refractive index of said lens for light emitted by said active region is greater than about 1.5.

13. (Original) The light emitting device of Claim 12, wherein said refractive index is greater than about 1.8.

14. (Original) The light emitting device of Claim 1, wherein a refractive index of said lens is greater than or equal to a refractive index of said semiconductor layers for light emitted by said active region.

15. (Original) The light emitting device of Claim 1, further comprising contacts electrically coupled to said semiconductor layers to apply a voltage across said active region.

16. (Original) The light emitting device of Claim 15, wherein at least one of said contacts is highly reflective for light emitted by said active region and is located to reflect said light toward said lens.

17. (Original) The light emitting device of Claim 1, further comprising at least one beveled side located to reflect light emitted from said active region toward said lens.

18. (Original) The light emitting device of Claim 1, further comprising at least one layer highly reflective for light emitted by said active region located to reflect said light toward said lens.

19. (Original) The light emitting device of Claim 1, wherein said transparent lens is directly bonded to at least one of said semiconductor layers.

20. (Original) The light emitting device of Claim 1, wherein said stack comprises a transparent superstrate layer disposed above said semiconductor layers and directly bonded to said lens.

21. (Original) The light emitting device of Claim 20, wherein said superstrate layer has a refractive index for light emitted by said active region greater than about 1.8.

22. (Original) The light emitting device of Claim 20, wherein said superstrate layer is formed from a material selected from the group of sapphire, SiC, GaN, and GaP.

23. (Previously Amended) The light emitting device of Claim 20, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, materials containing lead oxide, materials containing tungsten oxide, SiC, and ZnS, said superstrate is formed from a material selected from the group of SiC, GaN, and sapphire, and said semiconductor layers comprise III-Nitride semiconductors.

24. (Previously Amended) The light emitting device of Claim 20, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, materials containing lead oxide, materials containing tungsten oxide, SiC, ZnS, and GaP, said superstrate is formed from a III-Phosphide material, and said semiconductor layers comprise a material selected from the group of III-Phosphide semiconductors and III-Arsenide semiconductors.

25. (Currently Amended) ~~The A~~ light emitting device of ~~Claim 1, further comprising~~ comprising:

a stack of layers including semiconductor layers comprising an active region;
a transparent lens attached to said stack by a bond effected at an interface disposed
between said lens and said stack; and

a transparent bonding layer disposed between said lens and a surface of said stack,
said transparent bonding layer bonding said lens to said stack, said transparent bonding layer
having an index of refraction greater than about 1.8 for light emitted by said active region.

26. (Original) The light emitting device of Claim 25, wherein said transparent bonding layer is formed from a material selected from the group of optical glass, chalcogenide glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, organic semiconductors, metals, metal oxides, metal fluorides, yttrium aluminum garnet, phosphides, arsenides, antimonides, nitrides, and combinations thereof.

27. (Original) The light emitting device of Claim 25, wherein said transparent bonding layer includes one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

28. (Canceled).

29. (Canceled).

30. (Original) The light emitting device of Claim 25, wherein said bonding layer has a thickness less than about 500 Angstroms.

31. (Original) The light emitting device of Claim 25, wherein said surface includes a surface of one of said semiconductor layers.

32. (Original) The light emitting device of Claim 25, wherein said surface includes a surface of a transparent superstrate layer disposed above said semiconductor layers.

33. (Original) The light emitting device of Claim 32, wherein said superstrate layer has a refractive index for light emitted by said active region greater than about 1.8.

34. (Original) The light emitting device of Claim 32, wherein said superstrate layer is formed from a material selected from the group of sapphire, SiC, GaN, and GaP.

35. (Previously Amended) The light emitting device of Claim 32, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, materials containing lead oxide, materials containing tungsten oxide, SiC, and ZnS, said superstrate is formed from a material selected from the group of SiC, GaN, and sapphire, and said semiconductor layers comprise III-Nitride semiconductors.

36. (Previously Amended) The light emitting device of Claim 32, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, materials containing lead oxide, materials containing tungsten oxide, SiC, ZnS, and GaP, said superstrate is formed from a III-Phosphide material, and said semiconductor layers comprise a material selected from the group of III-Phosphide semiconductors and III-Arsenide semiconductors.

37-42. (Withdrawn).

43. (Previously Added) The light emitting device of Claim 23, further comprising a first contact and a second contact electrically coupled to apply a voltage across said active region; said first contact and said second contact disposed on a same side of said stack.

44. (Previously Added) The light emitting device of Claim 24, further comprising a first contact and a second contact electrically coupled to apply a voltage across said active region; said first contact and said second contact disposed on a same side of said stack.

45. (Previously Added) The light emitting device of Claim 35, further comprising a first contact and a second contact electrically coupled to apply a voltage across said active region; said first contact and said second contact disposed on a same side of said stack.

46. (Previously Added) The light emitting device of Claim 36, further comprising a first contact and a second contact electrically coupled to apply a voltage across said active region; said first contact and said second contact disposed on a same side of said stack.

47-50. (Canceled).

51. (Previously Added) The light emitting device of Claim 25, wherein said transparent bonding layer includes a lead oxide.

52. (Previously Added) The light emitting device of Claim 25, wherein said transparent bonding layer includes a tungsten oxide.

53. (Currently Amended) The light emitting device of Claim 1 wherein said bond ~~does not include~~ is substantially free of organic-based adhesives.

54. (Canceled).

55. (Previously Added) A light emitting device comprising:
a stack of layers including semiconductor layers comprising an active region;
a transparent lens; and
a transparent bonding layer disposed between said lens and said stack, wherein the transparent bonding layer bonds said stack to said transparent lens, and wherein the transparent bonding layer has a thickness less than about 500 angstroms.

56. (Previously Added) The light emitting device of Claim 55 wherein the transparent bonding layer contacts a surface of the transparent lens and a surface of the stack, wherein an average height of irregularities on said surface of the transparent lens and said surface of the stack are less than the thickness of the transparent bonding layer.

57. (New) The light emitting device of Claim 55, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, GaP, ZnS, materials containing lead oxide, materials containing tungsten oxide, and SiC.

58. (New) The light emitting device of Claim 25, wherein said transparent bonding layer comprises an inorganic material.

59. (New) The light emitting device of Claim 25, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, GaP, ZnS, materials containing lead oxide, materials containing tungsten oxide, and SiC.

60. A light emitting device comprising:

a stack of layers including semiconductor layers comprising an active region;

a transparent lens attached to said stack by a bond effected at an interface disposed between said lens and said stack; and

a transparent bonding layer disposed between said lens and a surface of said stack, said transparent bonding layer bonding said lens to said stack, said transparent bonding layer comprising an inorganic material.

61. (New) The light emitting device of Claim 60, wherein said transparent bonding layer is formed from a material selected from the group of optical glass, chalcogenide glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, metals, metal oxides, metal fluorides, yttrium aluminum garnet, phosphides, arsenides, antimonides, nitrides, and combinations thereof.

62. (New) The light emitting device of Claim 60, wherein said transparent bonding layer includes one or more luminescent materials that convert light of a wavelength emitted by said active region to at least another wavelength.

63. (New) The light emitting device of Claim 60, wherein said bonding layer has a thickness less than about 500 Angstroms.

64. (New) The light emitting device of Claim 60, wherein said surface includes a surface of one of said semiconductor layers.

65. (New) The light emitting device of Claim 60, wherein said bonding layer has an index of refraction greater than about 1.5 for light emitted by said active region.

66. (New) The light emitting device of Claim 60, wherein said surface includes a surface of a transparent superstrate layer disposed above said semiconductor layers.

67. (New) The light emitting device of Claim 66, wherein said superstrate layer has a refractive index for light emitted by said active region greater than about 1.8.

68. (New) The light emitting device of Claim 66, wherein said superstrate layer is formed from a material selected from the group of sapphire, SiC, GaN, and GaP.

69. (New) The light emitting device of Claim 66, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, materials containing lead oxide, materials containing tungsten oxide, SiC, and ZnS, said superstrate is formed from a material selected from the group of SiC, GaN, and sapphire, and said semiconductor layers comprise III-Nitride semiconductors.

70. (New) The light emitting device of Claim 66, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, materials containing lead oxide, materials containing tungsten oxide, SiC, ZnS, and GaP, said superstrate is formed from a III-Phosphide material, and said semiconductor layers comprise a material selected from the group of III-Phosphide semiconductors and III-Arsenide semiconductors.

71. The light emitting device of Claim 60, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, GaP, ZnS, materials containing lead oxide, materials containing tungsten oxide, and SiC.

72. (New) The light emitting device of Claim 60, wherein said transparent bonding layer includes a lead oxide.

73. (Previously Added) The light emitting device of Claim 60, wherein said transparent bonding layer includes a tungsten oxide.

74. (New) A light emitting device having a stack of layers including semiconductor layers comprising an active region, said device comprising:

a transparent lens attached to said stack by a bond effected at an interface disposed between said lens and said stack, wherein said bond is substantially free of organic-based adhesives and said lens has a height greater than a height of said stack.

75. (New) The light emitting device of Claim 74 wherein said lens is formed from a material selected from the group of optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors and compounds, metal oxides, metal fluorides, diamond, yttrium aluminum garnet, zirconium oxide, sapphire, GaP, ZnS, materials containing lead oxide, materials containing tungsten oxide, SiC, and combinations thereof.

76. (New) The light emitting device of Claim 74, wherein a refractive index of said lens for light emitted by said active region is greater than about 1.5.

77. (New) The light emitting device of Claim 74, wherein said refractive index is greater than about 1.8.

78. (New) The light emitting device of Claim 74, wherein said lens is formed from a material selected from the group of zirconium oxide, sapphire, GaP, ZnS, materials containing lead oxide, materials containing tungsten oxide, and SiC.

79. (New) A light emitting device comprising:

a stack of layers including semiconductor layers comprising an active region; and

a transparent lens attached to said stack by a bond effected at an interface disposed between said lens and said stack, the transparent lens comprising one of a lead oxide and a tungsten oxide..

80. (New) The light emitting device of Claim 78 wherein said bond is substantially free of organic-based adhesives.

REMARKS

Claim 1 is amended to include the limitations of claim 9. Claim 25 is amended into independent form and to include the limitations of claim 29. New claims 57-80 are added, including new independent claims 60, 74, and 79.

An information disclosure statement citing nine references is attached.

Four of the references cited in an information disclosure statement filed with this request for continued examination were cited in an office action in a continuation-in-part of the present application: Okazaki et al., U.S. Patent 6,495,862, Fairbanks et al., U.S. Patent 6,091,020, Bojarczuk Jr. et al., U.S. Patent 5,898,185, and Ming-Jiunn et al., U.S. Patent 5,917,201. Okazaki et al. was used to reject the claims in the continuation-in-part applications. The other references were not relied upon.

Okazaki et al. teach a device with a "transparent light lead-out layer 20" as shown in Fig. 9. Column 10, line 11 to column 11, line 21 describes this embodiment. Okazaki et al.'s Fig. 10 teaches a device with a "light lead-out layer 22" formed "on the backside of sapphire substrate 1." See, for example, column 11, lines 24-54.

U.S. Patent 6,483,196 to Wojnarowski et al. teaches at column 1, lines 56-59 "[o]ne or more layers of a lensing material is deposited on a bottom surface of the device substrate. The lensing material is comprised of a polymer, an index matching material, or a mixture thereof." Table 1 at column 5, lines 17-39 lists several examples of suitable polymer materials.

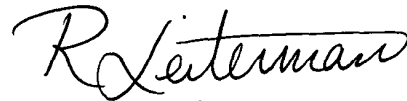
The attached information disclosure statement also cites three articles directed to glass structures and a machine translation of JP 09-153645. These references have not been reviewed in detail.

Applicants respectfully request allowance of all pending claims. Should the Examiner have any questions, the Examiner is invited to call the undersigned at (408) 382-0480.

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Respectfully submitted,



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